

Title: Picturesque Polygons

Brief Overview:

Students will apply their knowledge of polygons to design geometrical art pieces.

NCTM 2000 Principles for School Mathematics:

- **Equity:** *Excellence in mathematics education requires equity - high expectations and strong support for all students.*
- **Curriculum:** *A curriculum is more than a collection of activities: it must be coherent, focused on important mathematics, and well articulated across the grades.*
- **Teaching:** *Effective mathematics teaching requires understanding what students know and need to learn and then challenging and supporting them to learn it well.*
- **Learning:** *Students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge.*
- **Assessment:** *Assessment should support the learning of important mathematics and furnish useful information to both teachers and students.*
- **Technology:** *Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning.*

Links to NCTM 2000 Standards:

• Content Standards

Algebra

- *Understand patterns, relations, and functions.*

Geometry

- *Analyze characters and properties of two dimensional geometric shapes and develop mathematical arguments about geometric shapes.*
- *Specify locations and describe spatial relationships using coordinate geometry and other representational systems.*
- *Use visualization, spatial reasoning, and geometric modeling to solve problems.*

Measurement

- *Understand measurable attributes of objects and the units, systems, and processes of measurement.*
- *Apply appropriate techniques, tools, and formulas to determine measurements.*

• Process Standards

Problem Solving

- *Solve problems that arise in mathematics and in other content areas.*

Reasoning and Proof

- *Recognize reasoning and proof as fundamental aspects of mathematics.*

Communication

- *Organize and consolidate mathematical thinking through communication.*
- *Communicate mathematical thinking coherently and clearly to peers, teachers, and others.*
- *Analyze and evaluate the mathematical thinking and strategies of others.*
- *Use the language of mathematics to express mathematical ideas precisely.*

Connections

- *Understand how mathematical ideas interconnect and build on one another to produce a coherent whole.*
- *Recognize and apply contexts outside of mathematics.*

Grade/Level:

Grades 4 - 6

Duration/Length:

5 - 50 minute periods or 250 minutes

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- Open and closed figures
- Regular and irregular polygons
- Knowledge of basic shapes
- General angle identification
- Basic measurement skills
- Persuasive writing skills
- Friendly letter format

Student Outcomes:

Students will:

- utilize and apply generalized rules in patterns.
- apply the properties of one dimensional figures to reason and solve problems about shapes, size, position, while identifying and applying attributes.

Materials/Resources/Printed Materials:

- Gumdrops
- Toothpicks
- Student resource sheets
- Poster board (half a sheet per person)
- Crayons, markers, or colored pencils
- Shapes run on tag board (Students will need scissors to cut these out).
- Wax paper
- Math journals
- Paper to draw rough copy on
- Tag board template with various sizes of polygonal shapes (See Note 3.)
- For extension activities:
- Clay rolled into small balls

- Lollipop sticks
- Paper/pencil
- Crayons, makers, or colored pencils
- Blank paper stapled into book

Development/Procedures:

DAY 1

1. Warm up: Review open and closed figures. Teacher will draw several example of each on the overhead. Students will write in math journals whether each figure is opened or closed and give reasons for their identificaton. Teacher will discuss answers.
2. Allow students to sit in pairs and distribute the following materials:
 - 1 sheet of wax paper to use as a work mat
 - 20 gum drops
 - 10 whole toothpicks
 - 5 half toothpicks
 - Triangle description sheet (Student Resource Sheet 1)
3. Instruct students to make a triangle using toothpicks and gum drops. Discuss what makes this a triangle. Allow time for students to write down a definition after discussion.
3. Explain to the class that there are seven types of triangles and that they will use their prior knowledge of angles to write their own definitions of the triangles.
4. Instruct students to make an equilateral triangle with their gum drops and toothpicks. Ask them to pay attention to the word---What does the word sound like? Look at the triangle you have just made. What do you notice about the angles? Discuss with your partner a definition of equilateral triangle. Once the definition has been discussed, write it on the sheet.
5. Repeat steps 3-4 modeling the other types of triangles.
6. When students finish the activity, allow them to eat the gum drops.
7. Students can complete Student Resource Sheet 2 at the end of class or for homework. Answers are provided on Teacher Resource Sheet 2.

DAY 2

1. Warm up: Have students check their own answers to Resource Sheet 2. Answer any questions.
2. Pass out same materials from yesterday. Instead of triangle description sheet, pass out polygon description sheet. (Student Resource Sheet 3)
3. Instruct students to make a four-sided figure. Have them hold their figures in the air. Ask: What do they notice? (Students should notice at least two quadrilaterals.)
4. Explain that a polygon is a closed figure with three or more straight sides and that today they will be studying various kinds of polygons. (The root “poly” means many.)

5. As with the previous day's procedure have the students make the following shapes and write their own definitions: square, rectangle, decagon, hexagon, pentagon, octagon, rhombus, parallelogram, trapezoid. As teacher introduces each word, ask students if they hear any other small clue words in the larger word.

6. Students can complete Student Resource Sheet 4 for homework. Answers can found on Teacher Resource Sheet 4. Student Resource Sheet 5 also can be used.

DAY 3

1. Teacher calls out responses to previous night's homework and answers any questions they may have.

2. Teacher will distribute and explain expectations for Performance Assessment, Student Resource Sheet 6. Teacher also will explain that rough copies must be approved before students move on to final copies. Students may use resource pages from previous days.

3. Students will use the remaining time to begin the Performance Assessment.

DAY 4

1. Students will take out materials from the previous day and continue work on Performance Assessment. Teacher needs to remind students that he/she needs to see rough copies before they begin on final copies. Rough copies should be approved by the end of the class. (Posters only)

2. What student doesn't finish will become homework.

DAY 5

1. Students will present their projects and read letters to the class.

2. Students will vote for the 10 best posters to be displayed in the media center.

3. Teacher will collect work from all students.

Performance Assessment:

Mrs. Praet announced that there is too much white space on the walls in her media center. To brighten our media center up, you have been asked to design a poster using only the polygons that we have learned about in class. All posters must contain a theme. You may use a theme we discuss in class or an original idea of your own. When all posters have been completed, you will write a letter to the class to explain why your poster should be selected to the Geometry Wall of Fame.

All figures must be drawn using the templates provided. Posters must be neatly colored and contain a title relating to your theme. Your letter should use persuasive language and contain the mathematical terms we have learned in class. On presentation day, you will read your letter to your class and display your poster.

* See a Teacher Resource Sheet 5 for a rubric for poster and letter expectations.

NOTE: 1. Teacher resource sheets also included.

2. If students need additional shapes they may create their own through use of a draw program on the computer. For example: ClarisWorks, AppleWorks, etc.
3. In the event of working with severely disabled students, this lesson can be implemented by giving copies of teacher resource sheets 1 and 3. Student resource sheets 2 and 4 may be completed together as a class or independent work.

Extension/Follow Up:

- Students can work with their partners to create three dimensional figures out of clay and lollipop sticks. After students have created their figure, they can write step by step directions on how to make one. Students need to use mathematical terminology as they write their directions.
- Students can create a book about polygons to read to first or second graders. Books should be written in short sentences and have a picture on every page. Books also should have a front cover containing the title, author's name, picture, and summary statement.
- Students may also challenge their intellect by attempting to measure the angles provided on the various worksheets that are provided for them.

Authors:

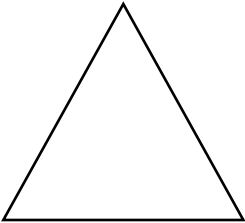
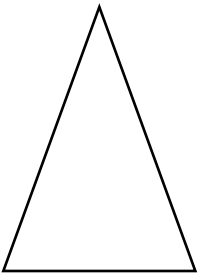
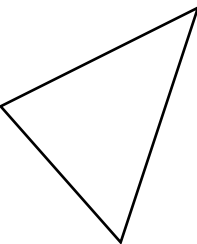
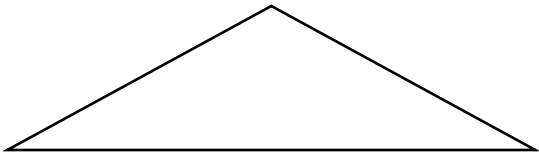

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Name _____

Type of Triangle	Picture of what the triangle looks like	What's special about this triangle
Equilateral triangle		
Isosceles triangle with 1 acute angle		
Scalene triangle with 1 acute angle		
Isosceles triangle with 1 obtuse angle		
Scalene triangle with 1 obtuse angle		

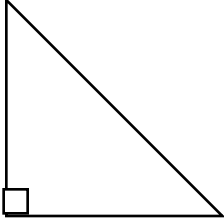
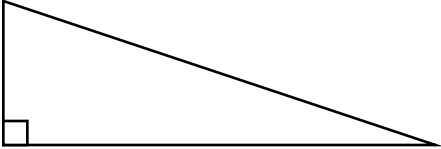
Name _____

Type of Triangle	Picture of what the triangle looks like	What's special about this triangle
Equilateral acute triangle		3 sides the same length and all angles are less than 90° .
Isosceles acute triangle		2 sides are the same length and all angles are less than 90° .
Scalene acute triangle		No sides are the same length and all angles are less than 90° .
Isosceles obtuse triangle		2 sides are the same length and one angle is greater than 90° .
Scalene obtuse triangle		No sides are the same length and one angle is greater than 90° .

Name _____

Type of Triangle	Picture of what the triangle looks like	What's special about this triangle
Isosceles triangle with 1 right angle		
Scalene triangle with 1 right angle		

Name _____

Type of Triangle	Picture of what the triangle looks like	What's special about this triangle
Isosceles right triangle		2 sides are the same length and one angle equals 90° .
Scalene right triangle		No sides are the same length and one angle equals 90° .

Name _____

Match the correct triangle name with the picture of it on the right.

1. _____ Isosceles triangle with 1 obtuse angle

2. _____ Scalene triangle with 1 right angle

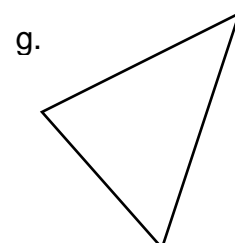
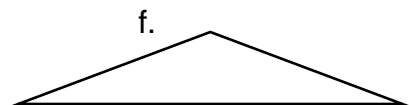
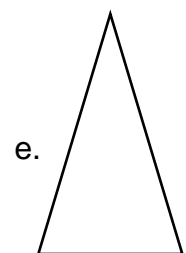
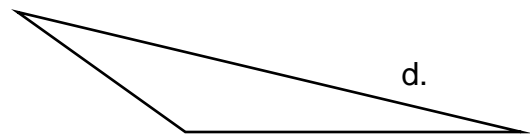
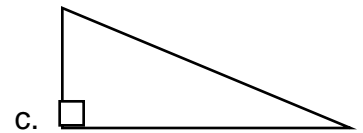
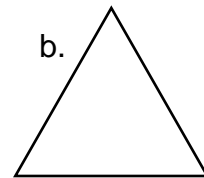
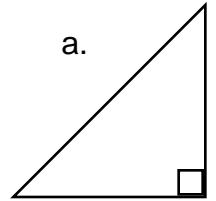
3. _____ Equilateral triangle with 1 acute angle

4. _____ Isosceles triangle with 1 acute angle.

5. _____ Scalene triangle with 3 acute angles

6. _____ Isosceles triangle with 1 right angle

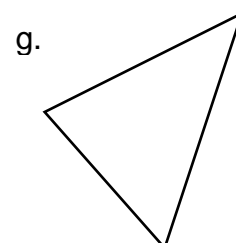
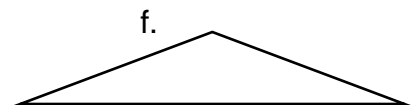
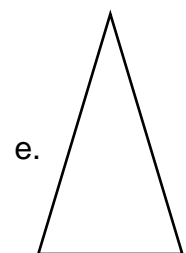
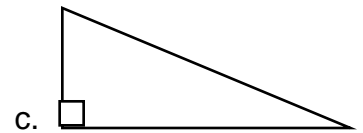
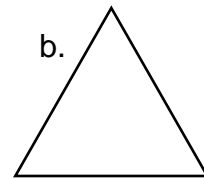
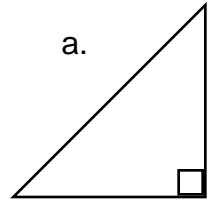
7. _____ Scalene triangle with 1 obtuse angle



Name _____

Match the correct triangle name with the picture of it on the ri

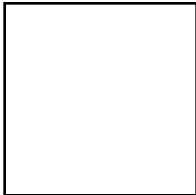

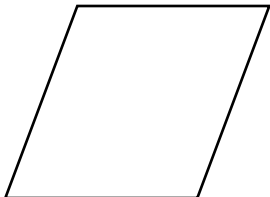
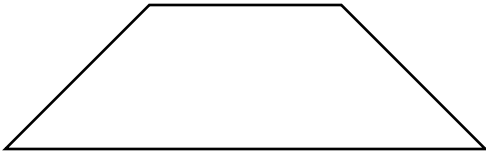
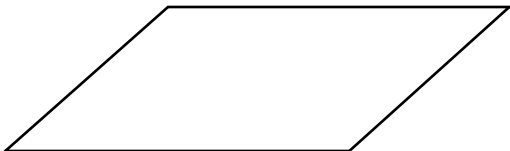
1. _____F___ Isosceles triangle with 1 obtuse angle
2. _____C___ Scalene triangle with 1 right angle
3. _____B___ Equilateral triangle with 1 acute angle
4. _____E___ Isosceles triangle with 1 acute angle
5. _____G___ Scalene triangle with 3 acute angles
6. _____A___ Isosceles triangle with 1 right angle
7. _____D___ Scalene triangle with 1 obtuse angle



Name _____

Type of polygon	Picture of what the polygon looks like	What's special about this polygon
Square		
Rectangle		
Rhombus		
Trapezoid		
Parallelogram		

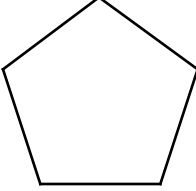
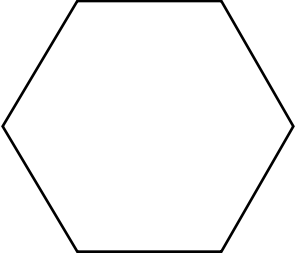
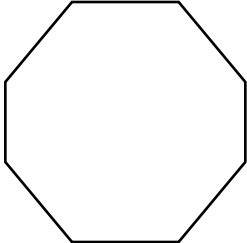
Name _____

Type of polygon	Picture of what the polygon looks like	What's special about this polygon
Square		Has two sets of parallel lines all four lines are equal in length. All four angles are 90° .
Rectangle		Has two sets of parallel lines has two sets of lines that are equal in length. All four angles are 90° .
Rhombus		Has two sets of parallel lines. All four lines are equal in length. Corresponding angles are congruent.
Trapezoid		Has one pair of parallel lines.
Parallelogram		Has two pairs of parallel lines. Has two sets of lines that are equal in length. Corresponding angles are congruent.

Name _____

Type of polygon	Picture of what the polygon looks like	What's special about this polygon
Pentagon		
Hexagon		
Octagon		

Name _____

Type of polygon	Picture of what the polygon looks like	What's special about this polygon
Pentagon		Has five sides.
Hexagon		Has six sides.
Octagon		Has eight sides.

Name _____

Match the correct polygon name with the picture of it on the right

1. _____ Parallelogram

2. _____ Octagon

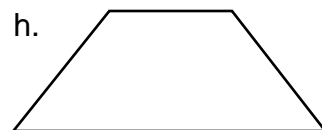
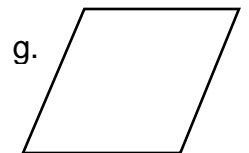
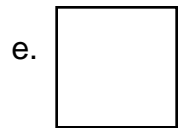
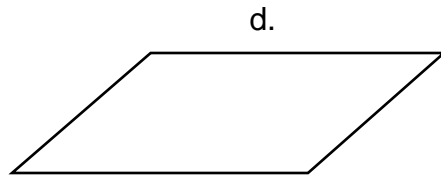
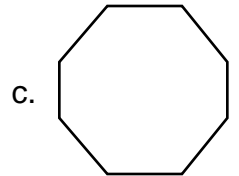
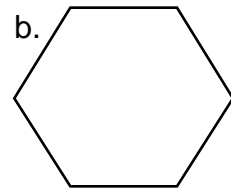
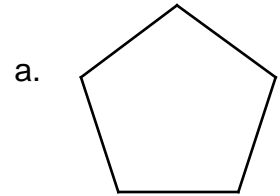
3. _____ Rectangle

4. _____ Square

5. _____ Rhombus

6. _____ Trapezoid

7. _____ Hexagon



Name _____

Match the correct polygon name with the picture of it on the right

1. _____D_____Parallelogram

2. _____C_____Octagon

3. _____F_____Rectangle

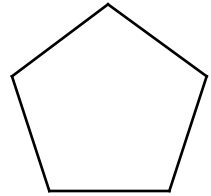
4. _____E_____Square

5. _____G_____Rhombus

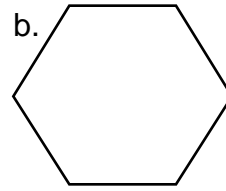
6. _____H_____Trapezoid

7. _____B_____Hexagon

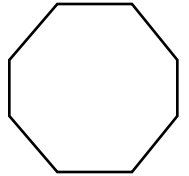
a.



b.



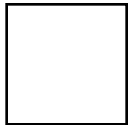
c.



d.



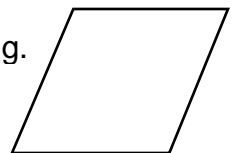
e.



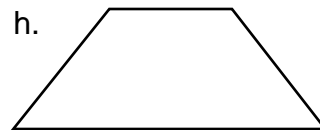
f.



g.

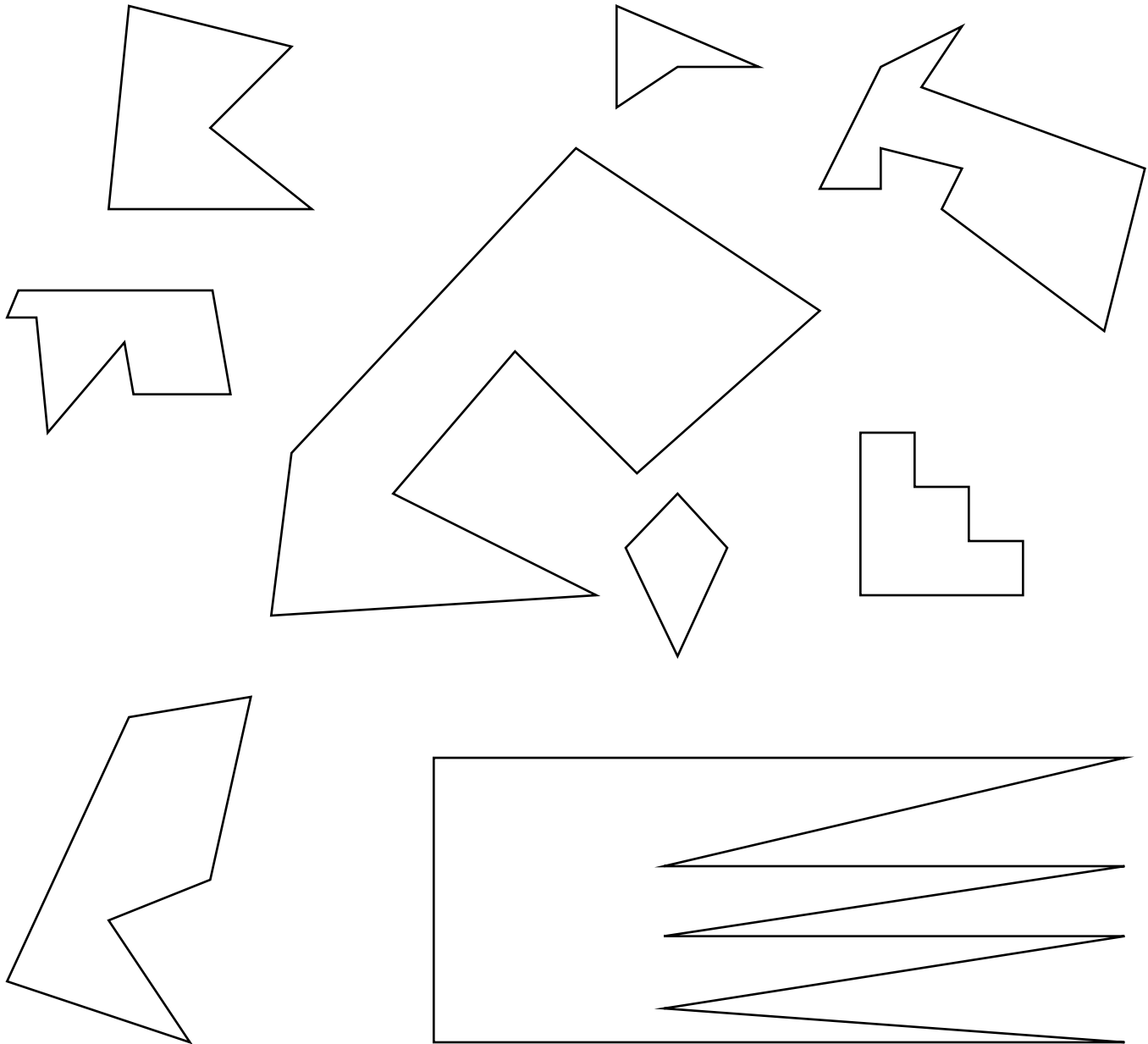


h.



Name _____

Observe the following shapes and decide whether they are polygons or not. On the reverse explain your reasoning why or why not. Be sure to use your text book and other sources to explain your answer.



Name: _____

Geometry Wall of Fame

Mrs. Praet has announced that she had too much white space on her walls. To brighten up our media center, you will design a poster using only the polygons that we have used in class. Your poster should contain a theme. You may use a theme we discussed or an original theme. When all posters are completed, you will write a letter persuading your classmates to vote for your poster to be displayed in the Wall of Fame.

All figures should be drawn using the templates provided or you may create your own template on the computer. Posters should be neatly colored and contain a title relating to your theme. Letters should be written in standard friendly letter form, use persuasive language, and mathematical terms to describe your picture.

You may use the space below to brainstorm ideas for a theme.

Rubric for Wall of Fame

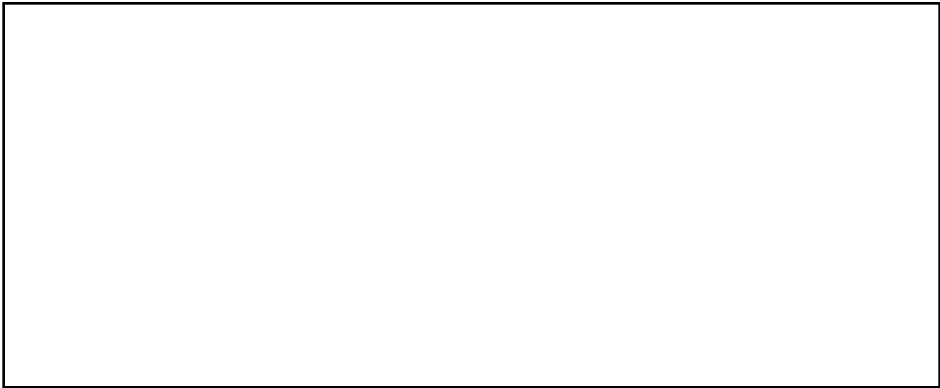
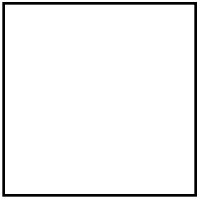
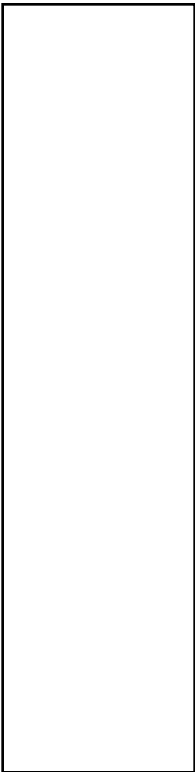
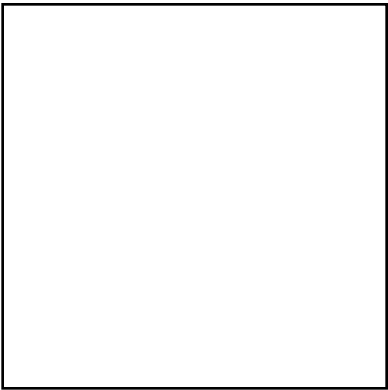
Poster:

- 4** - Student demonstrates knowledge of a variety of polygons, is neatly colored, contains a theme, and has drawn all figures with the templates provided.
- 3** - Student demonstrates three of the criteria listed above.
- 2** - Student demonstrates two of the criteria listed above.
- 1** - Student demonstrates one of the criteria listed above

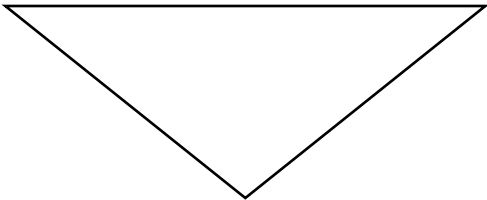
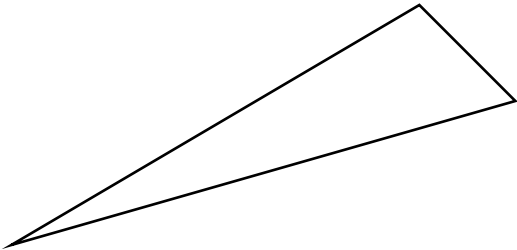
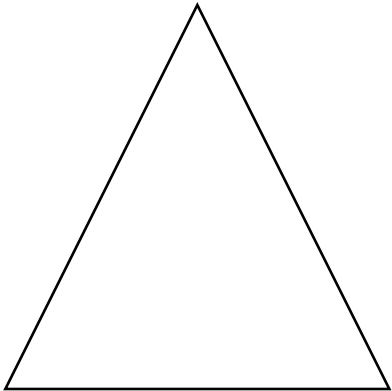
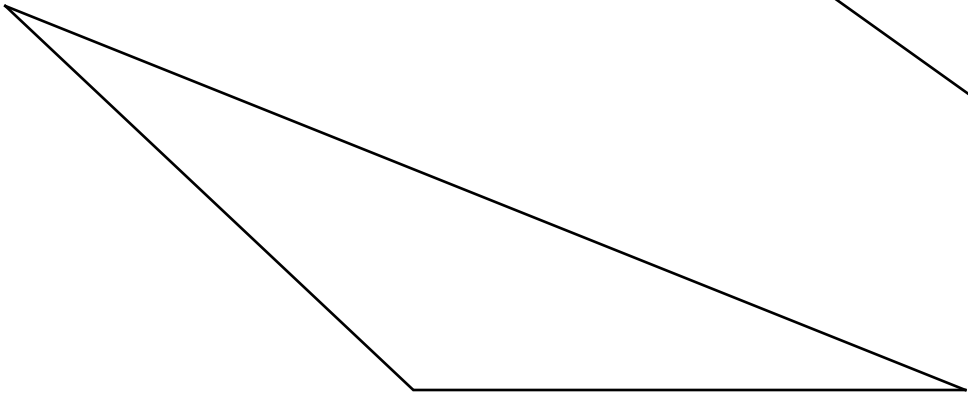
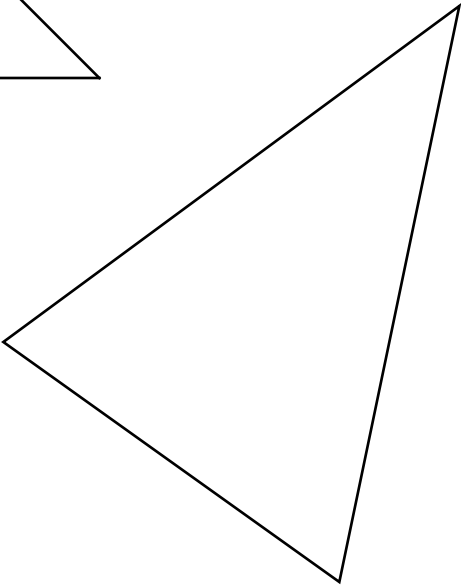
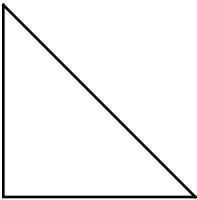
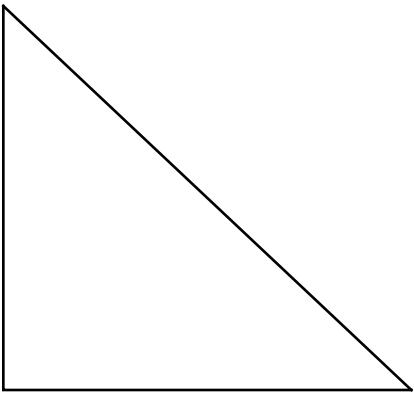
Letter:

- 4** - Letter contains a greeting, date, body, closing and signature; persuasive language and describes picture in mathematical terms; letters should also be neatly written.
- 3** - Letter contains three of the criteria listed above.
- 2** - Letter contains two of the criteria listed above.
- 1** - Letter contains one of the criteria listed above.

Shape Sheet 1



Shape Sheet 2



Shape Sheet 3

